Instituto Tecnológico y de Estudios
Superiores de Monterrey

Center for Artificial Intelligence

Sucursal de Correos "J" Monterrey, N.L. 64849, México

Instituto Tecnológico y Estudios Superiores de Monterrey

Center for Artificial Intelligence

CAI

Center for Artificial Intelligence
ITESM, Monterrey Campus

The Center for Artificial Intelligence (CAI) was established in 1989 to consolidate the academic and industry-related work accomplished since the early 80s at the Informatics Research Center. Currently it is developing and transferring technology that solves problems relevant to the Mexican industry.

The CAI explores and develops concepts, techniques and methodologies in artificial intelligence (AI) to find solutions to academic and application problems.

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Objetive

Promote and develop basic and applied research in artificial intelligence.

Provide support for the development of human resources through doctoral, master and specialization programs.

Facilitate the transfer of AI technology to Mexican industry.

Research Areas

Areas of research are determined on the basis of scientific and technological advances in artificial intelligence, the potential impact that these advances have on organizations, and the research interests of the center's faculty members. The following lines have been identified:

Knowledge Engineering

Knowledge acquisition, knowledge modelling at intermediate levels, knowledge representation, automated reasoning, KBS validation.

Machine Learning

Induction, analogy, explanation and case-based learning, genetic algorithms, neural networks, cognitive systems.

Intelligent Robotics

Computer vision, speech recognition, plan generation, intelligent control, intelligent manufacturing, robot programming.

Parallel Processing

Massive parallel computing, cellular automata, concurrent programming, distributed AI.

Intelligent Decision Support Systems

Expert systems and DSS, intelligent executive information systems.

Problem domains

The following classes of problems are being investigated

- Diagnosis and Repair
- Monitoring and Control
- Design (Planning and Scheduling)

Work is being done in the following problem domains:

- Manufacturing: production, maintenance, process control
- Human Resources: assessment and matching of candidates and job positions profiles
- Sales: technical support for salesmen and clients
- Finance: banking, underwriting, stock trading
- Medicine

Types of industries for which projects are being developed include:

- Steel
- Chemical
- Bank
- Textile
- Plastic
- Brewery

CAI

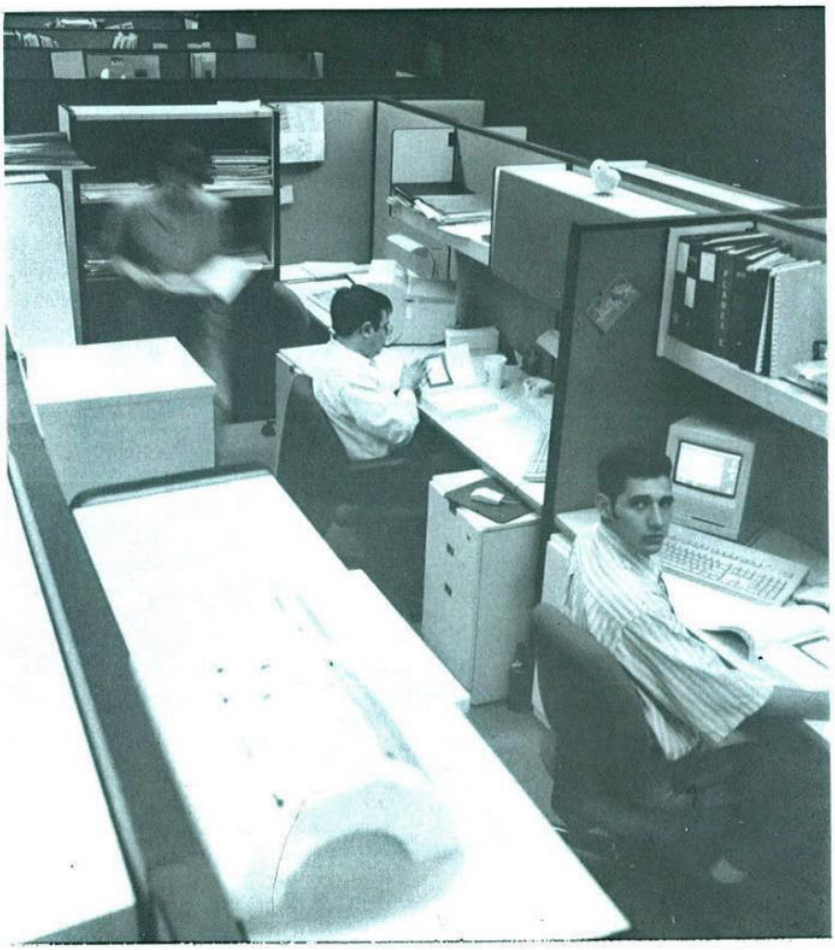
Problem domains

The following interest groups are being established among ITESM Monterrey Campus faculty

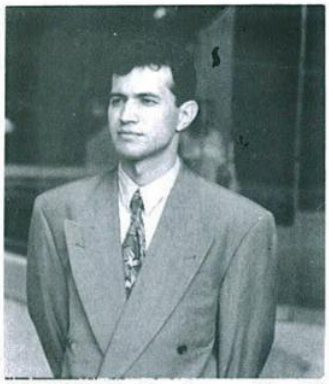
- AI in Control Engineering
- AI in Chemical Engineering
- AI in Electrical Engineering
- AI in Civil Engineering
- AI in Manufacturing
- AI in Mechanical Engineering
- AI in Industrial Engineering
- AI in Finance
- AI in Medicine
- AI in Quality Control

Human Resources

The Center for Artificial Intelligence relies on the services of 12 faculty members, 7 adjunct professors, 9 faculty members pursuing doctoral degrees abroad, 5 adjunct researchers, 8 professors from associated universities, 20 research assistants who contribute to research work while studying in graduate programs and 12 part-time undergraduate students in Computer Science.



Faculty



José Luis Aguirre Cervantes

Docteur en Informatique, Institut National Polytechnique de Grenoble, France, 1989.

Associate professor of Computer Science and Artificial Intelligence. Research interest areas: Formal Knowledge Models. Tools for Diagnostic Problem Solving. Future research areas: Machine Learning Coordinated projects: Expert System for Diagnosing Quality Defects on Cellophane Film Production (Knowledge-Based Systems). Expert System for Controlling Salt Production (Knowledge-Based Systems).

Representavive publications:

AGUIRRE J.L. CELLOS : An Expert System for Diagnosing Quality Defects on Cellophane Film Production in Proceedings of The World Congress on Expert Systems. Orlando, Florida December 16-19 1991

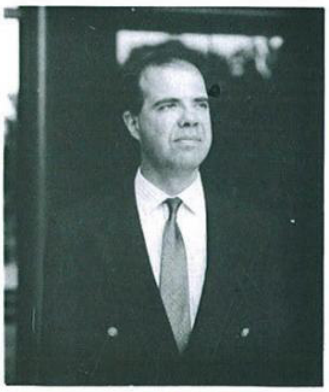
AGUIRRE J.L. Consistency Checking in Object Knowledge Models. IBERAMIA 90. Morelia, Méx. July 9 - 13 1990.

AGUIRRE J.L. Construction Automatique de taxonomies à partir d'exemples dans un modèle de connaissances par objets. PhD Dissertation, INP Grenoble, 1989

C. PEQUEGNAT, L. BATTANDIER, HUBERT E., AGUIRRE J.L. "Natural language interface for relational data base inquiry", in *8th International Workshop EXPERT SYSTEMS & THEIR APPLICATIONS* Avignon, May 30 - June 3, 1988, Vol. 1, pp. 441-460

AGUIRRE J.L. "A Taxonomic Construction System Based on an Object Oriented Knowledge Representation", in *Proceedings of the International Symposium EXPERT SYSTEMS, Theory and Applications.* IASTED Geneva, Switzerland, June 16 - 18, 1987, pp. 220-224 (Hamza, ed.) ACTA PRESS, Zurich

AGUIRRE J.L., BLOCH D., RECHENMANN F., ROUIBAH N. "SHIRKA: compilation, explanation and consistency in object oriented knowledge bases", in french in *Proceedings of the congress Intelligent Machines and Networks-87 (Machines et Réseaux Intelligents MARI-87)*, Paris, May 18-22, 1987, pp. 423-431



Ramón Brena Pinero

Docteur en Informatique, Institut National Polytechnique de Grenoble, France, 1989.

Professor of Computer Science and Artificial Intelligence. Research interest Areas: Programming and Knowledge-Based Systems Environments, Formal Deduction Systems and Automated Reasoning. Implementation on a computer of methodologies for KBS construction. This will take the form of an environment (an integrated set of tools). Formalization of those methodologies in order to exploit their mathematical properties. The focus is on diagnosis problems. Coordinated projects: Expert System project on Diagnosis for a polyethilene machine.

Representative publications:

R.Brena, M-L.Potet.- *Knowledge Specification in Program Synthesis*, AIICSR-89 CONFERENCE, organized by the Academy of Sciences of the USSR (Checoslovaquia, November 1989).

R.Brena.- *Parallelizing a Natural Deduction System.* In: Artificial Intelligence III: Methodology, Systems, Applicacions (O'Shea & Sgurev eds.), Elsevier Science Publishers, North Holland (1988).

R.Brena, R.Caferra, B.Fronhoefer, C.Gresse, P.Jacquet, M-L.Potet.- *Program Synthesis through Problem Splitting: A method for subproblem characterization.* Computers and Artificial Intelligence, vol.4 no.5, pp.421-429 (1985)

Faculty

Moraima Campbell Dávila

M.A., Management Science, ITESM, 1989.

Assistant professor of Information Systems. Research interest areas: Software engineering, user-interface design, integration of multimedia, expert systems and data bases in applications, desktop publishing. Coordinated projects: Human interface desing for projects MacPlan, Tecnet Service, MeacChatter. Expert systems and multimedia, Database system for ISAI.

Representative publications:

"The New User Interface Design", AdDA, 1991

"Notes on Structured Analysis and Design", ITESM, 1989

"The User Interface", CIA Informati on Bulletin, 1989.

Francisco J. Cantú Ortiz

M.Sc., Computer Science, North Dakota State University, 1978.

Director of the Center for Artificial Intelligence and Full Professor of Computer Science and Artificial Intelligence. Research interest areas: Knowledge acquisition, modeling and representation; automated reasoning; machine learning; AI applications and technology transfer. Coordinated projects: Expert systems in menufacturing for CYDSA Corporation, AI Techniques in steel industry for HYLSA, Medical expert systems for ITESM Medical Scool.

Representative publications:

Cantu-Ortiz, F. (ed.), Operational Expert Systems in Mexico, Pergamon Press, New York, 1992.

Cantu-Ortiz, F, *"An Overview of Expert Systems in Mexico"*, Operational Expert Systems in Mexico, (F. Cantu-Ortiz, ed.) Pergamon Press, New York, 1992.

Cantu-Ortiz, F. *"Expert Systems in Manufacturing*: An experience in Mexico". Expert Systems with Applications: An International Journal (J. Liebowitz, ed.), 3(4) Pergamon Press, New York, 1991

Cantu-Ortiz, F., García, M. *"An Expert System for Diagnosing Problems in Boiler Operation"*, Proceedings of the World Congress on Expert Systems (J. Liebowitz., ed.), Pergamon Press, New York, 1991.

Cantu-Ortiz, F. , *"Human Resources Formation in Knowledge Engineering: Experiences in Staffing Expert Systems Development Teams"*, Heuristics: The Journal of Knowledge Engineering, 4(2) pp 32-42, Special Avignon '91 Edition, Systemsware Corporation, Rockville MD, 1991.

Faculty

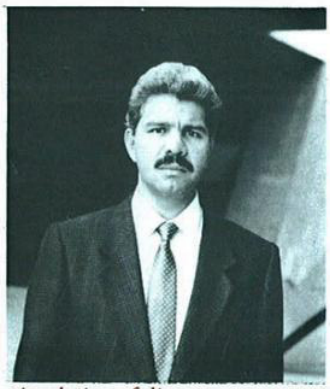
José Luis Gordillo Moscoso

Docteur, Informatique, Institut National Polytechnique de Grenoble, France, 1988.

Associate Professor of Computer Science and Artificial Intelligence.
Research interest areas: Computer vision and digital image processing, robotics and automation, computational geometry and parallel processing.
Coordinated projects: Proyecto Policyd: Sistema de monitoreo y control inteligente del proceso de fabricación de resina PVC. Alcoa Reconocimiento de fusibles de colores para ensamble automatizado. Diagnóstico ortodóntico automatizado.Diagnóstico ortodóntico automatizado, a partir de imágenes radiográficas.

Representative publications:

[Demazeau, Gordillo 85] Y. Demazeau et J.L. Gordillo: *A color stereo vision system applied to wire identification and localization*. 4th Canadian CAD/CAM & Robotics Conference.Toronto, June 1985, pp 12.1-12.8.
[Lux, Gordillo 85] A. Lux et J.L. Gordillo: *Synthetizing vision programs from robot task specifications*. 3rd International Symposium on Robotics Research. Gouvieux (France), October 1985, MIT Press, pp 149-154.
[Gordillo 87] J.L. Gordillo: *CAICOU: L'analyse d'images couleur*. Traitement du Signal (TS), 4(3). Octobre 1987,pp 217-228.
[Gordillo 90] J.L. Gordillo: *LE: A high level language for specifying vision verification tasks*. 1991 IEEE International Conference on Robotics and Automation. Sacramento, CA. April 1991. pp 1433-1439



Luis Ernesto López Mellado.

Docteur-Ingénieur in Automation University of Toulouse, France, 1986.

Professor of Control Engineering and Artificial Intelligence.
Research interest areas: Automation of manufacturing systems. Task programming and execution control of robotized cells. Petri nets applications in manufacturing.Coordinated projects: Decision support system for operating an ingot reheating stage in a hot- rolling steel process. Model and knowledge based scheduling for discrete event systems. A task programming environment for manufacturing cells.

Representative publications:

E. Arjona, E. López. *Automatic synthesis of coloured Petri nets for real-time simulation of discrete event systems*. Int. Simulation Technology Conference. Orlando, Fla. USA, Oct. 1991
O. Núñez, E. López. *LPER: a high level programming language for an industrial robot*. Fourth Latinamerican Conference on Automatic Control. Puebla, Mexico. Nov. 1990.
E, Arjona, E. López. *A computer language for the modelling of flexible manufacturing systems*. 13th IASTED Symposium robotics and manufacturing. Santa Barbara Cal. USA. Nov. 1990.
A. Ramírez, E. López. *Qualitative modeling of assembly tasks in robot cells using coloured Petri nets*. Second International Conference on Computer Integrated Manufacturing. Troy, N.Y USA. May 1990.
E. López, R. Alami. *A failure recovery scheme for assembly workcells*. IEEE International Conference on Robotics and Automation. Cincinnati, Ohio USA, May 1990.
E. López, G. Escalada. *A scheme for on-line failure diagnosis in assembly workcells*. IFAC Workshop on Reliability Availability of Industrial Process Control Systems. Brugges, Belgium 1988.

Arnulfo Pérez Pérez

Ph.D., Electrical Engineering, University of Tennessee, 1989.

On leave as visiting professor at the Kyushu Institute of Technology, Japan, 1989-92. Research interest areas: Digital image processing, parallel architectures.

Representative publications:

A. Pérez, M.A. Abidi, and R. C. González, *"Experimental Evaluation of Hypercube-Based Range Analysis Tools,"* Proceedings of the 10th International Conference on Pattern Recognition: Computer Architectures for the Vision and Pattern Recognition, June 1990, Atlantic City, New Jersey.

A. Pérez, Parallel Segmentation of Range Images on a Hypercube-Connected Distributed Computer, PH. D. dissertation, Department of Electrical and Computer Engineering, University on Tennessee, Knoxville, December 1989.

A. Pérez, M. A. Abidi, and R. C. Gonzalez, *"A Parallel Environment for Structural Analysis of Range Imagery, "* Proceedings of the SPIE Conference on Digital and Optical Shape Representation and Pattern Recognition, April 1988, Orlando Florida.

A. Pérez and R. C. Gonzalez, *"An Iterative Dynamic Theresholding Agorithm for Image Segmentation,"* IEEE Transactions on Pattern Analysis and Machine Intelligence, November 1987.

A. Pérez, M. A. Abidi, and R. C. Gonzalez, *" Parallel Fitting of Quadric Patches for Structural Analysis of Range Imagery"* Proceedings of the SPIE Conference on Visual Communications and Image Proceedings II, Vol. 845, October 845.

Pablo Ramírez Flores

M. Sc., Electronic Engineering, ITESM, 1990.

Associate Professor of Computer Science and Electronic Systems. Research interest areas: Microprocessor and Microcontroller Systems, Computer Architecture, Digital Circuits, Computer -Networks and Protocols, CAD/CAM.

Coordinated project: Tecnet Link, SETRED, SECCAM.

Representative publications:

"Diseño de una tarjeta de interfase Macintosh SE - Token Ring", Master Thesis, ITESM, 1990.

"Desarrollo de un puente de comunicación Localtalk-Token Ring" Intercambio de Experiencias, ITESM, 1990.

Faculty

José M. Sánchez García

Ph.D., in Industrial Engineering, University of Texas at Arlington, 1990.

Full Professor of Industrial Engineering and Artificial Intelligence. Research interest areas: Utilization of artificial Intelligence techniques for developing manufacturing. Coordinated Projects: Concurrent engineering, design for manufacturing, computer-aided process planning, computer integrated manufacturing, CAD/CAM, and intelligent decision support systems. Expert system for acrylic fiber processing machine maintenance. Expert system for water treatment. Exert system for boiler operation control. Intelligent feature based approach for design for producibility. Intelligent process planning assistant for circuit board assembly. Current research areas: Intelligent decision support system for developing Printed Circuit Boards (PCB's) in concurrent engineering environments. Future research areas: Feature-based design methodology for predictive design paradigms. Computer abstract reasoning design system. Intelligent concurrent design system for manufacturing. Expert system for computer-aided process planning. Representative publications:

Sánchez, J. M., John W. Priest and Pruchya Piumsomboon. "An Intelligent Feature Based Approach for Design for Producibility", Manufacturing International Conference, ASME, Dallas Texas, March 29-April 1, 1992

Sánchez, J. M. and Pruchya Piumsomboon. "Producibility Measurements," Invited Manuscript for inclusion in the Design for Manufacturability Volume 6 of the SME Tool and Manufacturing Engineers Handbook series, Editor-in-Chief: Mr. Ramon Bakerjian, Society of Manufacturing Engineers, Dearborn, Michigan, February, 1991.

Priest, J. W., José M. Sánchez, and Kevin Pare. "Process Planning for Electronic Components", Invited Manuscript for inclusion in a Wiley Reference Book on Intelligent Design and Manufacturing, Editor-in-Chief: Professor Andrew Kusiak, Department of Industrial Engineering and Management, The University of Iowa, January, 1991.

Rogelio Soto Rodríguez

Ph.D., Electrical Engineering, University of Texas at Arlington, 1990.

Associate Professor of Control and Electrical Engineering.

Interest areas CAD for control systems, variable structure control, artificial intelligence in control systems.

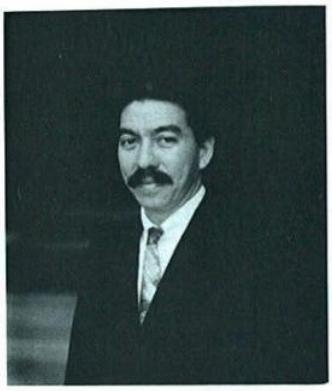
Coordinated projects: Real-time expert system for direct reduction process - AI in control systems Expert systems for continuouns foundry control-AI in control systems.

Representative publications:

R. Soto-Rodríguez and Kai. S. Yeung: "*Robust control of an induction motor*" IEEE Transactions on Industrial Electronics (Submitted for publication) .

R. Soto-Rodríguez and Kai. S. Yeung: "*Sliding-mode control of an induction motor without flux measurement* " IEEE Transactions on Industry Applications. (Submitted for publication) .

Faculty



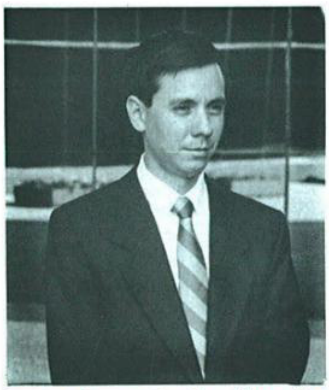
Hugo Terashima Marín

M.Sc., Computer Science, University of Oklahoma, Norman, OK, 1987.

Associate Professor of computer science and artificial intelligence. Research interest areas: Knowledge-based Systems (Acquisition and representation), parallelism and algorithms, scheduling problems. Coordinated projects: Intelligent Scheduler for Crysel - Scheduling systems. Expert system in XEROX - KBS.

Representative publications:

SEHUSI an Expert System for describing Human Behavior in a work environment, chapter in book "Operational Expert Systems in México", Pergamon Press, 1991.



Manuel Valenzuela Rendón

Ph.D., Electrical Engineering, University of Alabama, 1989.

Associate Professor of control engineering.

Research interest area: Optimization and design by means of nature inspired methods including genetic algorithms and simulated annealing. Intelligent control based on learning classifier systems, fuzzy controllers, and neural networks. Coordinated projects: An intelligent system for steel roll annealing scheduling. Current research areas: Solving scheduling and other ordering problems using genetic algorithms. Deception in genetic algorithms and its relation to other blind search methods. Fuzzy logic and its applications in learning classifier systems. Future research areas: A genetic algorithm theory of deception for scheduling and other ordering problems. Combining fuzzy controllers and genetic algorithms based machine learning for intelligent control.

Representative publications: Smith, R. E., & Valenzuela-Rendón, M. (1989). A study of rule development in a learning classifier system. In J. D. Schaffer (Ed.), *Proceedings of the third international conference on genetic algorithms* (pp. 340-346). San Mateo, CA: Morgan Kaufmann.

Valenzuela-Rendón, M. (1989). *Two analysis tools to describe the operation of classifier systems* (Doctoral dissertation, TCGA Report No. 89005). Tuscaloosa: The University of Alabama, The Clearinghouse for Genetic Algorithms.

Valenzuela-Rendón, M. (1991). The fuzzy classifier system: Motivation and first results. In H. P. Schwefel & R. Männer (Eds.), *Parallel problem solving from nature* (pp. 330-334). Berlin: Springer (Verlag).

Valenzuela-Rendón, M. (1991). The fuzzy classifier system—A classifier system for continuosly varying variables. In R. K. Belew y L. B. Booker (Eds.) *Proceedings of the fourth international conference on genetic algorithms* (pp. 346-353). San Mateo, CA: Morgan Kaufmann.

Faculty doing Ph. D. work abroad

Mario Aguilar. B.Sc., Computer Science, Jacksonville State University, 1989. Neural networks, cognitive systems. Currently attending Boston University.

Nora E. Aguirre. M.Sc., Information Systems, ITESM, 1986. Natural language, neural networks and expert systems. Currently attending Indiana University.

Ignacio Celis. M.Sc., Computer Science, Indiana University, 1989. Microprocessors, digital logic, data structures, object programming. Currently attending Indiana University.

José Luis Contreras. M.Sc., Electrical Engineering, University of Colorado at Boulder, 1989. Computer vision and digital image processing, neural networks. Currently attending Boston University.

Mario García. M.Sc., Computer Science, ITESM 1991, M.Sc. Control Engineering ITL, 1986. Real-time expert systems. Currently attending Texas A&M University

Rocío Guillén. M.Sc., Artificial Intelligence, Institut Technologique de Compiegne, France, 1984. Natural language, knowledge representation, expert system applications, and uncertainty management. Currently attending New Mexico State University.

Octavio Juárez. M.Sc., Computer Science, CINVESTAV 1990. Machine learning. Currently attending New Mexico State University.

Horacio Martínez. M.Sc., Control Engineering, ITESM, 1986. Adaptive control, neural networks, speech recognition and robotics. Currently attending Iowa State University.

Eduardo Uresti. M.Sc., Mathematics, CINVESTAV, 1988. Automatic theorem proving, intelligent tutoring systems. Currently attending ITESM.

Adjunct Faculty from ITESM´s departments or centers

Joaquín Acevedo. M.Sc., Chemical Engineering ITESM, 1990. Chemical Engineering Department. Expert systems in process systems, simulation.

Salvador Arreola. Ph.D., Industrial Engineering, Georgia Institute of Technology 1989. Industrial Engineering Department. Intelligent systems in decision support.

Graciano Dieck. Ph.D., Electrical Engineering, University of Texas at Austin, 1983. Electrical Engineering Department. Process optimization, intelligent control, and microprocessors applications in artificial intelligence

José Luis González Velarde. Ph.D., Mechanical Engineering, University of Texas in Austin, 1990. Manufacturing Systems Center. AI techniques in design and manufacturing engineering.

Carlos Pfiffer M.Sc., Control Engineering, ITESM, 1990. Computer Science Department. Real-time expert systems, adaptive control, robotics.

Carlos Rojas Mora. Doctor, Medicine. Applications of AI in medicine.

Carlos Scheel Mayenberger, Ph.D., Electrical Engineering, University of Houston, 1976. Director of the Graduate Informatics Program. Knowledge-based systems, decision-making processes, computer-based educational systems.

Faculty from associated universities

Participate either as graduate course teachers, theses supervisors, project advisors, seminar instructors or lecturers:

Dr. S. Lakhsmivarahan, Full Professor, University of Oklahoma. Parallel architectures, scientific computing, automated reasoning.

Dr. Robert Cartwright, Full Professor, Computer Science Department, Rice University. Theory of programming languages, semantics of programming languages.

Dr. Robert Dale, Lecturer Artificial Intelligence Department and Center for Cognitive Science, University of Edinburgh, Scotland. Natural Lenguage understanding, computational linguistics.

Dr. Newton Ellis, Full Professor, Industrial Engineering, Department Texas A&M University. Human factors, knowledge acquisition and engineering, expert/knowledge based systems.

Dr. Robert Fisher, Lecturer, Artificial Intelligence Department, University of Edinburgh, Scotland. Computer vision.

Dr. Randolph Goebel, Associate Professor, Computer Science Department, University of Alberta. Mathematical logic, automated reasoning, semantics of programming language.

Dr. Jay Liebowitz, Full Professor, Management Science Department, The George Washington University. Knowledge Based and Expert Systems.

Dr. Dick Simmons, Full Professor, Computer Science Department, Texas A&M University. Artificial intelligence, software engineering, computer architecture, expert systems.

Departmental Computer Resources

Hardware

3 Sun SparcStation 2 4/75, 1, Sun SparcStation 1+, 2 VaxStation, 1 NextStation, 1 RS/6000 550.

15 Macintosh II's, 10 Macintosh SE's, 8 Macintosh Plus's, 15 IBM PS2/80, 60 and 50.

2 Laser Writers and 12 Image Writer II's, 2 image digitizers and 3 Apple CD ROM players.

All the equipment is interconnected via Ethernet, Token Ring and Apple Talk local networks thiough bridges and gateways.

Software

Artificial intelligence languages:

Lisp (Sun Common Lisp, Allegro Common Lisp, Golden Common Lisp, OPS5 Macintosh, OPS5 Vax, Mac and PC Scheme),

Prolog (Mac Prolog and M Prolog), Light Speed C++, MPW C, LightSpeed Pascal, MPW Pascal with MacApp

Operating Systems Ultrix, AIX, VMS, MVS, DOS, Smalltalk, Macintosh.

Development tools Nexpert-Object, Level 5 Object, G2, CLIPS, ART-IM, Expert System Environment, M. 1. Personal Consultant Plus, PC Images, PC On Line, VP Expert, Exsys, First Class.

Training Room

Facility for training knowledge engineers, equipment with 20 IBM PS/2 70's

Departmental Computer Resources

University computer resources

- Access to IBM 4381, Vax 6310, MicroVax II, IBM RS/6000, IBM 9021 at ITESM Estado de México Campus, Cray YMP2/116,
- Campus network: Ethernet and Token Ring (Optic fiber backbone),
- International networks: Bitnet, Internet, AppleLink, Thenet, CSnet, NSFnet, Arpanet,
- Access to all ITESM campuses (26) via a satellite network.

Services

The Center for Artificial Intelligence offers the following services:

- **Academic**
  - Research and development through master's and doctoral theses
  - Teaching of undergraduate courses in computer science and engineering
  - Teaching of master's and doctoral courses in the Informatics and Engineering Graduate Programs.

- **Technology Transfer**
  - Diploma in Expert Systems
  - Certificate Program in knowledge Engineering
  - International Symposia on Artificial Intelligence (ISAI)
  - Lecture Series in Expert Systems and Artificial Intelligence for high-level management
  - Special presentations on the use of artificial intelligence and expert systems
  - Training of kowledge engineers.

- **Knowledge Engineering Projects**
  Joint development of knowledge-based and expert systems in manufacturing, engineering, medicine, agriculture, human resources, marketing, finance, control engineering, and robotics.

Corporate Sponsors and Projects

CIA has mid-term agreements for research and development in expert systems with a variety of firms. The following are among the most important:

CYDSA Group. Research and development of expert systems in manufacturing for textile and chemical plants.

- boiler operation control
- maintenance of acrylic fiber processing machines
- color control in rayon fiber
- diagnosing color problems in acrylic fiber
- maintenance of tooth paste tube machines
- real-time reactor control
- production programming
- coagulation machine control in a cellophane plant
- interpretation of pyschometric tests
- industrial-use water analysis
- cellophane film cutting and finishing

HYLSA. Research and development in AI applications for the steel industry.

- Intelligent system for programming steel lingot reheating
- Intelligent system for programming steel roll annealing
- Real-time expert system for direct reduction process
- Expert system for continuous foundry control

PYOSA. Research and development in applications for chemical processes.

- Design of chemical formulation for making colorants
- Technical support in sales

CONACYT, CYDSA, HYLSA.